

ABSTRACT OF THE DISCLOSURE

In a substrate cleaning apparatus, particles attached to the surface of the substrate are dislodged and removed using a shock wave created by high-speed flow of a gas stream in a tube or slot that is juxtaposed with respect to the surface to be cleaned. The shock wave is generated in a controlled gap between the substrate and the tube or slot. The pressure differential may result from either a reduced pressure or an increased pressure in the tube or slot with respect to an external pressure. With this technique, particles and process residue (from etch, CMP, etc.) may be effectively removed from the surface. The substrate may be a reticle or a semiconductor wafer, though other types of substrates, including other substrates used in semiconductor manufacturing processes, also may be cleaned.